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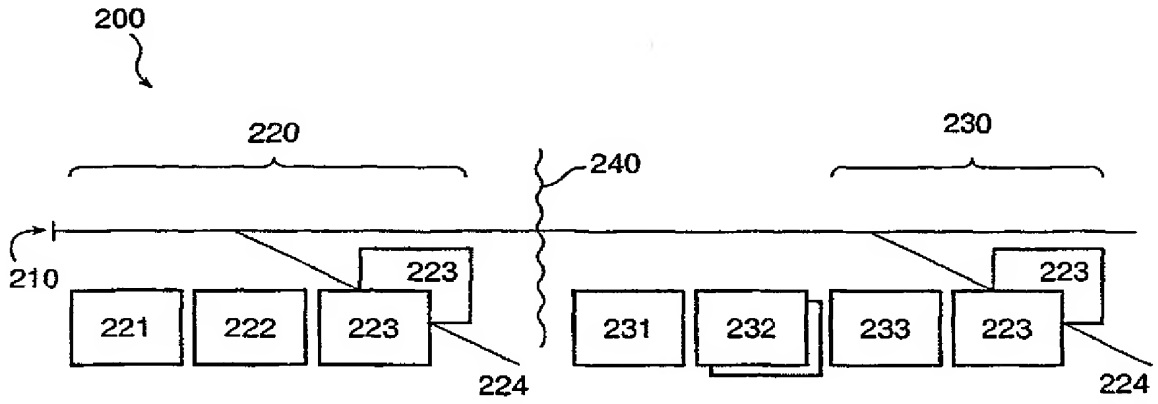
(54) Title: ADAPTIVE LINK LAYER FOR POINT TO MULTIPOINT COMMUNICATION SYSTEM




(57) Abstract: The invention provides a method and system for a wireless transport layer, such as for use in a wireless communication system. In a preferred embodiment, the wireless transport layer includes the capability for instructing customer premises equipment to adjust the physical characteristics on its communication link with the base station controller, and for instructing customer premises equipment to conduct further communications using those new physical characteristics. The wireless transport layer includes a number of provisions for adjusting communication between the base station controller and customer premises equipment in view of the prospect of adjusting physical characteristics for communication between the two end points. The use of a point-to-multipoint wireless channel provides services over a link whose parameters are continuously adapting to current conditions on a per-user basis.

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**AMENDED CLAIMS**

[received by the International Bureau on 10 August 2001 (10.08.01);
original claims 1-35 replaced by amended claims 1-48 (8 pages)]

1. A method, including steps of

determining first values for a set of parameters for a communication link, in a first layer of an OSI model communication system;

sending information using said first values;

obtaining information regarding characteristics of said communication link;

adjusting said first values in response to said information, whereby further use of said communication link is responsive to said steps of adjusting;

determining alternative values for said set of parameters for a second communication link in said communication system;

sending information using said second communication link;

obtaining alternative information regarding characteristics of said second communication link; and

adjusting said alternative values in response to said alternative information, whereby further use of said second communication link is responsive to said steps of adjusting.

2. A method is in claim 1, wherein said first values include at least two of: an antenna selection value, a power level value, a channel selection value, a modulation type value, a symbol rate value, an error code type value, a set of equalization values.

4. A method as in claim 1, wherein said steps of adjusting said alternative values are responsive to a result of said steps of adjusting said first values.

5. A method as in claim 1, wherein said steps of determining alternative values are responsive to a result of said steps of determining first values.

6. A method as in claim 1, including steps of

determining second values for a set of parameters for communication link, in a second layer of said communication system;

adjusting said second values and responses said information; and

wherein said steps of sending information use said second values.

7. A method is in claim 6, wherein

said first layer includes a media access layer; and

said second layer includes at least one of: a physical layer, a network layer, a transport layer, an application layer.

8. A method is in claim 6, wherein

said first layer includes a physical layer; and

said second layer includes at least one of: a media access layer, a network layer, a transport layer, an application layer.

9. A method is in claim 1, wherein said second values include at least one of: a message size value, a set of acknowledgment and retransmission values, a TDD duty cycle value.

10. A method as in claim 1, wherein said steps of adjusting include

determining second values in response to said information; and

combining said first values and said second values;

whereby said first values are adjusted in response to a result of said steps of combining.

11. A method is in claim 10, wherein said steps of combining include adaptively altering said first values using at least one hysteresis parameter.

12. A method is in claim 1, wherein said steps of determining are responsive to a higher-level layer in said communication system.

13. A method is in claim 12, wherein

said first layer includes a media access layer; and

said second layer includes at least one of: a network layer, a transport layer, an application layer.

14. A method is in claim 12, wherein

said first layer includes a physical layer; and

said higher-level layer includes at least one of: a media access layer, a network layer, a transport layer, an application layer.

15. A method, including steps of

dynamically determining characteristics of a communication link between a first device to a second device;

dynamically sending first information regarding said characteristics from said first device to said second device;

receiving said information at said second device;

dynamically sending second information between said first device and said second device using said characteristics, in response to said first information.

16. A method as in claim 15, wherein said communication link includes a wireless communication link.

17. A method as in claim 15, wherein said communication link includes a time division multiple access communication link.

18. A method as in claim 15, wherein

said first information includes a plurality of said characteristics, each one of said plurality of characteristics possibly being different from each other one of said plurality of characteristics;

each one of said plurality of characteristics being specific to one said second device of a plurality of said second devices.

19. A method as in claim 15, including the steps of

choosing a timebase to allow for link adaptation in such a way that said chosen time base is independent of the said communication link parameters; and

fragmenting and reassembling data units in such a way that the fragment size (measured in ticks) remains constant regardless of the nature of said communication link parameters.

20. A method as in claim 15, wherein said communication link parameters are responsive to the relative frequency with which packets are dropped, rather than responsive to various other measurements.

21. A method as in claim 15, wherein

said communication link includes a portion of a duplex communication link, said duplex communication link having a structure including sequential frames;

said first information is sent from said first device to one or more said second devices during a designated frame of said duplex communication link;

said first information is used to control said steps of dynamically sending second information during said same designated frame of said duplex communication link.

22. A method as in claim 21, wherein said sequential frames include frame descriptor packets that describe the contents of the next said sequential frame.

23. A method as in claim 21, wherein

said duplex communication link includes, for each said frame, a downstream portion and an upstream portion;

said first information is sent during said downstream portion of said designated frame;

said steps of dynamically sending include sending information during said downstream portion of said same designated frame or said upstream portion of said same designated frame.

24. A method as in claim 15, wherein

said communication link includes a sequence of frames, each having a map section and one or more payload elements;

said first information is sent during said map section of a designated frame; and

said steps of dynamically sending include sending information during said payload elements of said same designated frame.

25. A method as in claim 15, wherein said steps of dynamically sending include requesting upstream bandwidth in such a way that the number of said payload elements is expressed as a number of bytes rather than a number of packets.

26. A method as in claim 15, wherein the step of dynamically sending includes sending a Sync packet that synchronizes said first device and said second device.

27. Apparatus including

means for dynamically determining characteristics of a communication link between a first device to a second device;

means for dynamically sending first information regarding said characteristics from said first device to said second device;

means for receiving said information at said second device;

means for dynamically sending second information between said first device and said second device using said characteristics, in response to said first information.

28. Apparatus including

a first device capable of sending information to a second device using a communication link;

said first device being capable of dynamically determining characteristics of said communication link for use in communicating with said second device;

said first device being capable of formatting first information for sending to said second device regarding said characteristics, and capable of at least one of (a) formatting second information for sending to said second device using said characteristics, or (b) receiving information from said second device using said characteristics.

29. Apparatus as in claim 28, wherein said first device includes a transmitter for sending information using a wireless communication link.

30. Apparatus as in claim 28, wherein said first device includes a timer for sending or receiving information using a time division multiple access communication link.

31. In a method for sending information between a first device to a second device, a data structure including a frame in a sequence of frames for transmission, each said individual frame including

first information regarding characteristics of a communication link between said first device and said second device;

second information for communication between said first device and said second device, said second information using said characteristics from said same individual frame.

32. A data structure as in claim 31, wherein said communication link includes a wireless communication link.

33. A data structure as in claim 31, wherein said communication link includes a allocated duration of time within said same individual frame.

34. A data structure as in claim 31, wherein said frame includes a time division multiple access communication link.

35. A data structure as in claim 31, wherein said first information includes a plurality of said characteristics for a corresponding plurality of said communication links between said first device and a corresponding plurality of said second devices.

36. A method, including steps of

determining first values for a set of parameters for a communication link, in a first layer of an OSI model communication system;

sending information using said first values;

obtaining information regarding characteristics of said communication link; and

adjusting said first values in response to said information, whereby further use of said communication link is responsive to said steps of adjusting;

wherein said steps of adjusting include

determining second values in response to said information; and

combining said first values and said second values;

whereby said first values are adjusted in response to a result of said steps of combining.

37. A method is in claim 36, wherein said first values include at least two of: an antenna selection value, a power level value, a channel selection value, a modulation type value, a symbol rate value, an error code type value, a set of equalization values.

38. A method as in claim 36, including steps of

determining alternative values for said set of parameters for a second communication link in said communication system;

sending information using said second communication link;

obtaining alternative information regarding characteristics of said second communication link; and

adjusting said alternative values in response to said alternative information, whereby further use of said second communication link is responsive to said steps of adjusting.

39. A method as in claim 36, wherein said steps of adjusting said alternative values are responsive to a result of said steps of adjusting said first values.

40. A method as in claim 36, wherein said steps of determining alternative values are responsive to a result of said steps of determining first values.

41. A method as in claim 36, including steps of

determining second values for a set of parameters for communication link, in a second layer of said communication system;

adjusting said second values and responses said information; and

wherein said steps of sending information use said second values.

42. A method is in claim 41, wherein

said first layer includes a media access layer; and

said second layer includes at least one of: a physical layer, a network layer, a transport layer, an application layer.

43. A method is in claim 41, wherein

said first layer includes a physical layer; and

said second layer includes at least one of: a media access layer, a network layer, a transport layer, an application layer.

44. A method is in claim 36, wherein said second values include at least one of: a message size value, a set of acknowledgment and retransmission values, a TDD duty cycle value.

45. A method is in claim 36, wherein said steps of combining include adaptively altering said first values using at least one hysteresis parameter.

46. A method is in claim 36, wherein said steps of determining are responsive to a higher-level layer in said communication system.

47. A method is in claim 46, wherein

said first layer includes a media access layer; and

said second layer includes at least one of: a network layer, a transport layer, an application layer.

48. A method is in claim 46, wherein

said first layer includes a physical layer; and

said higher-level layer includes at least one of: a media access layer, a network layer, a transport layer, an application layer.